REMARKS

Applicant wishes to thank the Examiner for reviewing the present application and acknowledges that claims 28, 29 and 32 have been deemed allowable.

Claims 1, 3, 6-7, 20-23, 25-27, and 30-31 have been rejected under 35 U.S.C. 103(a) as being unpatentable over George (US 6,175,655) in view of Udupa (US 5,812,691). Applicant respectfully traverses the rejections as follows.

As previously argued, by looking at data points along the path, points that are not on the structure can be avoided. In this way, not only distance but also direction are used to determine which points are to be examined. Claim 1 recites assigning a value of connectivity based on the distance of the respective point from the initial location and by <u>monitoring variations in a predetermined parameter along a path between the data points and utilizing a function employing variations in the parameter as an indicator of the value of connectivity</u>. Applicant respectfully submits that neither George nor Udupa, either alone or in combination teach such a technique.

Firstly, contrary to the Examiner's position, in George, the concept of looking at a path is completely overlooked. George describes the concept of "fuzzy distance" and "fuzzy membership". However, this is described in terms of adjacent points, not in terms of a path. See for example, Figure 16, and related passage from George copied below:

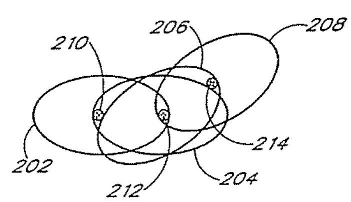
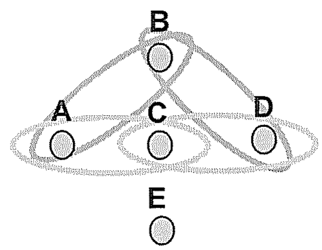


FIG. 16

With particular reference to FIG. **16**, this process is repeated to define all of the points which belong to a common set of data points and define the anatomical structure of interest. Structuring element **202** formed about point **210** defines point **212** as being included within the data set, structuring element **204** formed about point **212** similarly defines point **210** as belonging to the common data set, while structuring element **206** formed about point **212** defines point **214** as belonging to the common data set. Thus, all points which lie within the boundary of any structuring element at which a point within the data set is formed at the center thereof, also are members of the common data set.

Each point so defined to be within the data set is assigned a fuzzy membership number between zero and one, depending upon the distance between adjacent points, as discussed above.

As can be seen from the above, George defines fuzzy membership based on the distance between adjacent points, and in no way teaches or suggests looking at the path between points in a structure. George does not clarify how the distance should be calculated for a point which has multiple neighbors in the structure of interest. For instance, assume the following configuration:



Point D can be reached using the path A-B-D or the Path A-C-D. In general, the value of membership will be different. George does not describe how such situation shall be handled.

In the present application however, Applicant associates the connectivity according to variations in a parameter along a path. The concept of path is therefore an important aspect and should not be overlooked when comparing claim 1 to George. In fact, the actual membership may depend heavily on the path used to reach a single point, as the distance does depend on it.

Also, George defines connectivity (or membership) purely based on the fuzzy distance, not on the actual pixel's value. George established that two points which are within a specific distance have membership to the same group of point :

> To define connectivity, this algorithm uses a fuzzy generalization of mathematically defined distances between sets as a connectivity criterion. This criterion establishes that if two points or two sets of points are within a specified distance of one another, then they have membership to the same set of points. To more precisely define this concept of connectivity, the neighborhood of points and the data must be defined.

Furthermore, George states that from the fuzzy distance, the fuzzy connectivity can be directly computed:

> the fuzzy connectivity. The fuzzy connectivity or fuzzy measure may range from zero to one. The fuzzy connectivity can be directly mapped or determined as a function of the fuzzy distance. The fuzzy connectivity is determined by

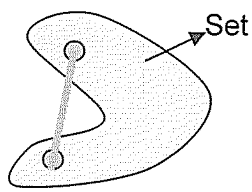
This is a significant difference from what is recited in claim 1. For example, in the

present application the equations used to define the connectivity of the pixel depends on its location, its pixel value and the value of its neighbor (which will affect the path to reach such pixel).

Finally, George assumes convex sets. The definition of connectivity assumes that the sets segmented are convex:

> As mentioned above, connectivity is a mathematical concept which states that a set of points is connected if and only if every pair of points in the set can be connected by a line contained in the set. The algorithm described in this

In fact, for a non convex object, such as a kidney or a bean-shape object, it is possible to find two points which segment is not included in the set :



In the technique recited in claim 1, a <u>path</u> should exist between the two points, and such path should be completely inside the set. This is another example that highlights that George does not include the concept of path in the connectivity definition.

In view of the above, Applicant believes that George not only fails to teach the incorporation of the threshold (as acknowledged by Examiner in office action) but also fails to teach the concept of monitoring variations in a parameter along a path between the data points.

The Examiner has cited Udupa as teaching what is missing from George. Applicant will now address the improper combination of George and Udupa and show that neither reference teaches monitoring variations in a parameter along a path between the data points, even when combined.

Udupa does define the concept of path in the definition of the connectivity, as equation 13:

Equation 13

$$\mu_K(c,d) = \max_{p \in P_{cd}} [\mu_N(p)].$$

> The intuitive idea underlying the principle of fuzzy connectedness as described herein is to assign to every pair of spels (c, d) in C a "strength of connectivity" between them. This strength is determined as follows. There are numerous possible paths between c and d (expressed by the set P_{cd}). Along each path p, there is a "weakest link" (in the sense of the smallest affinity between spels along p) that determines the strength of connectivity along p. The actual "strength of connectivity" from c to d is the maximum of the "strength" of all paths. In the definition of "strength", α, C, and κ all play important roles.

However, Udupa does not include the <u>variation of a parameter</u> (such as the distance) along the path as recited in claim 1. In fact, Udupa states that $\mu_K($ is transitive:

> Since K is transitive, for all (c,d), (d,e), (c,e) in C×C,
>
> $$\mu_K(c,e) = \max_{d \in C} [\min[\mu_K(c,d), \mu_K(d,e)]]. \qquad \text{Equation 15}$$

This equality is no longer valid once you add a path-dependent variable, such as path length.

Therefore, neither George nor Udupa, either alone or in combination, teaches monitoring variations in a predetermined parameter along a path between data points as recited in claim 1. For at least this reason, claim 1 is believed to be patentable over George in view of Udupa.

Notwithstanding the above, Applicant also believes that George and Udupa, even if combined, would not work together without undisclosed modifications that are not readily apparent from even a careful review of both references. For instance, equation 13 in Udupa defines the fuzzy connectivity and this is completely different from what is defined by George in column 14 at line 60 and column 17 at lines 33-43. It is unclear how such definitions of connectivity would even work together as they utilize entirely different parameters and principles. It is believed that the Examiner has relied on hindsight in rejecting claim 1 in view of George and Udupa, which is improper. Applicant believes that claim 1 as previously entered is clearly and patentably distinguished over George in view of Udupa as explained above.

Claim 23 also includes the features discussed above and thus is also believed to be patentably distinguished. Claims 3-22, 24-27 and 30 to 31, being dependent on either claim 1 or claim 23 are also believed to be patentably distinguished for at least that reason.

Claims 4 and 5 have been rejected under 35 U.S.C. 103(a) as being unpatentable over George in view of Udupa, in further view of Zhang (US 2003/0144598); claims 8-9 and 24 have been rejected under 35 U.S.C. 103(a) as being unpatentable over George in view of Udupa, in further view of Dellepiane (IEE Vol. 5, No. 3 March 1996 pp. 429-446); and claims 10-19 and

28-29 have been rejected under 35 U.S.C. 103(a) as being unpatentable over George in view of Udupa, in further view of Turek (US 6,754,376). Applicant respectfully traverses the rejections as follows.

Firstly, Applicant assumes that the rejections of claims 28-29 is in error as these claims have been deemed allowable. Secondly, the additional references cited do not teach what is believed to be shown as missing from George and Udupa. Therefore, Applicant respectfully submits that claims 4, 5, 8, 9, 10-19, and 24 are also believed to be patentable over the cited references.

Applicant requests early reconsideration and allowance of the present application.

Respectfully submitted,

Brett J. Slaney
Agent for Applicant
Registration No. 58,772

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BLAKE, CASSELS & GRAYDON LLP
199 Bay Street
Suite 2800, Commerce Court West
Toronto ON M5L 1A9
Canada

Tel: 416-863-2518
BS/